

March 9, 1965

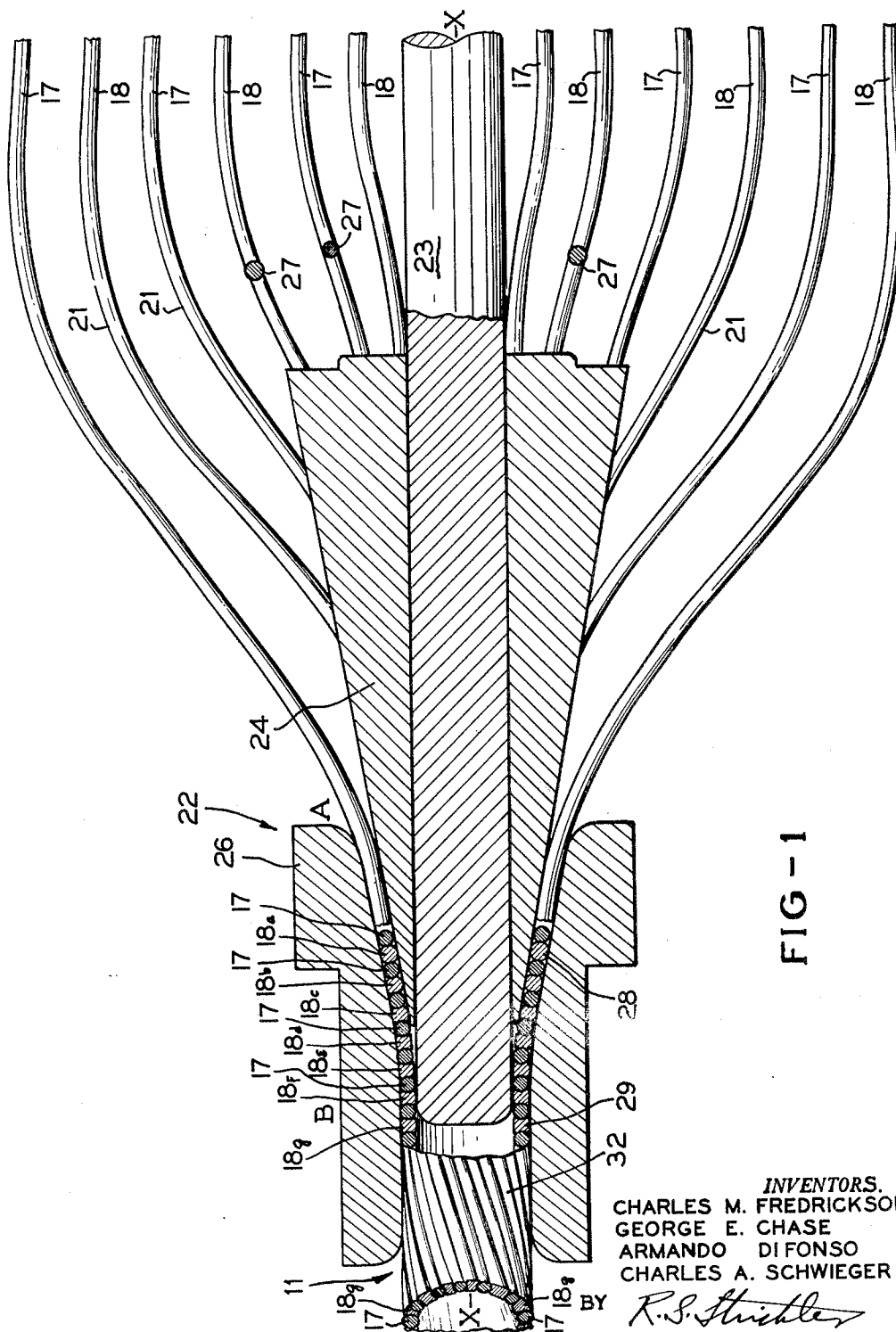
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HOLLOW CORE CABLE

Filed Oct. 27, 1960

2 Sheets-Sheet 1



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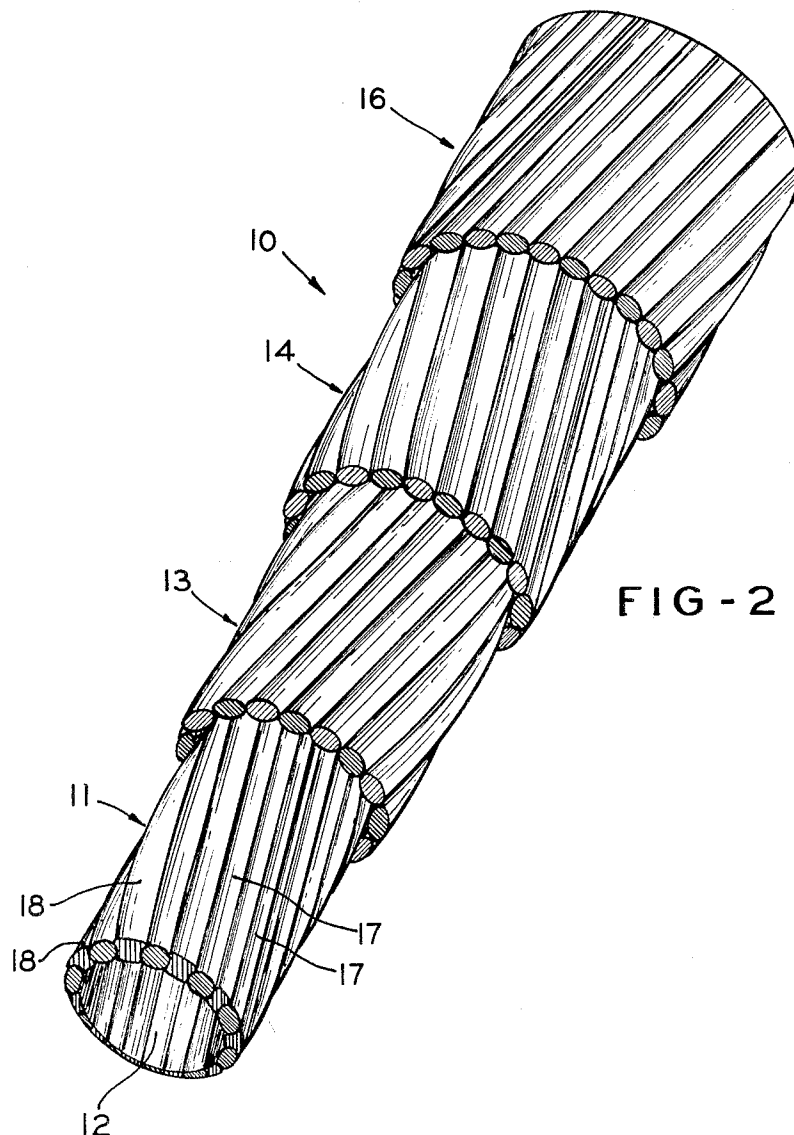
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3,172,947

HOLLOW CORE CABLE

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3 Claims. (Cl. 174-130)

The present invention relates to stranded cables and in particular to hollow stranded cables including the method of fabricating hollow cables.

A particular feature of the present invention is the provision of a stranded cable useful in electrical power transmission having a central core region which is hollow.

A further feature of the invention is the provision of a stranded hollow core cable of the character described wherein the hollow core or cavity within the cable is maintained by a special arrangement of the strands, wires or conductors utilized to form the cable.

Another feature of the invention is the provision of a stranded cable comprising a plurality of layers of strands, wires or conductors where the cable is formed with a hollow core; the hollow core being developed without the use of any additional instrumentalities such as tubes, fillers, spacers or similar structural elements.

A further feature of the invention is the provision of a multi-layered stranded hollow core cable wherein the innermost layers is fabricated from a plurality of strands which are keyed or nested together to provide a flexible hollow core where the individual strands of said innermost layer are operable to resist a circumferential stress tending to collapse the innermost layer in a radially inward direction.

Another feature of the present invention is the provision of a novel process for stranding a multi-layered hollow core cable.

Another feature of the invention is the provision of a novel process for deforming strands.

A still further feature of the invention is the provision of a process for combining a plurality of strands or filaments to form a cable wherein alternate strands of a given layer are utilized to deform intermediate strands to the extent that all strands in said given layer are keyed or nested together to provide a flexible layer of strands having a hollow core which exhibits a resistance to radial thrust tending to collapse the hollow layer inwardly.

A process embracing certain features of the present invention may comprise the steps of advancing a plurality of strands towards a forming die in continuous fashion, rotating the strands relative to the direction of advance so as to introduce a uniform lead in the strands, selecting the strands so that alternate strands are relatively hard and intermediate strands are relatively soft thereby susceptible of deformation, providing sufficient restriction in the die through which all the strands pass so that the hard strands perform work upon the soft strands effective to deform the soft strands with the result that a single hollow layer of strands is formed which is keyed or locked to one another against radial deformation while retaining the overall flexibility ordinarily found in a stranded cable.

A stranded cable embracing certain features of the present invention may comprise a plurality of layers of strands in which an inner hollow core layer is formed of a plurality of cooperating strands, said cooperating strands being innerlocked or nested one within the other.

Other features and advantages of the present invention will become more apparent from an examination of the succeeding specification when read in conjunction with the appended drawings in which:

FIG. 1 is a schematic view of a plurality of strands dis-

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posed about a forming die showing, schematically, the process steps practiced to produce the inner hollow core layer of strands.

FIG. 2 is a perspective view of a portion of a hollow core cable embracing the principles of the present invention and including a plurality of conventional layers carried by the central hollow layer.

Referring now in detail to the drawings, there is shown a hollow core cable indicated generally by the reference numeral 10 comprising an inner layer 11 having a hollow core 12 and additional conventional layers 13, 14 and 16 stranded upon the hollow layer 11 where each layer is stranded with a spiral or lead of opposite hand to the layer next adjacent.

The inner layer 11 is formed of a plurality of anvil strands 17 fabricated of a relatively hard material, such as steel, rigid plastic, or like materials, and of a plurality of malleable strands, referenced by the numeral 18, fabricated of a relatively soft or malleable material, such as aluminum, copper, low molecular weight polyolefins, or like materials.

Note that the anvil strands 17 of the finished cable shown in FIG. 2 are generally circular in cross section and are partially received within or keyed to the malleable strands 18. The anvil strands 17 can be said to have a generally circular configuration in cross section while the malleable strands 18 have a dumbbell-like contour in cross section.

The interlocking or keyed relationship between the anvil strands 17 and the malleable strands 18 in the layer 11 are operative to provide a rigid, hollow, flexible structure which presents resistance to a crushing load and which provides, in effect, a tube-like configuration capable of supporting a plurality of additional layers of strands, such as are identified by the reference numerals 13, 14 and 16.

Note that the strands forming the additional layers 13, 14 and 16 are generally circular in configuration and need not be nested or keyed to one another in the fashion of the layer 11.

As stated previously, the hollow core cable embracing the principles of the present invention and as illustrated in FIG. 2 is constructed and arranged primarily by utilization of strands or filaments and the finished cable is entirely free of internal supports, such as tubes, spacers, or other similar structural elements.

Referring now to FIG. 1, there is shown a plurality of anvil strands 17—17 alternately arranged relative to malleable strands 18—18 where each strand is formed with an appropriate preform, as at 21, for a purpose which will be described in greater detail hereinafter.

The strands 17—17 and 18—18 are illustrated advancing from a plurality of reels individual to each strand mounted on the rotatable cage or drum of a convention rotary strander (not shown).

The strands 17—17 and 18—18 are rotated by the strander about a central axis, indicated by the letters X—X while drawn through an annular forming die, indicated generally by the reference numeral 22.

The die 22 comprises a central mandrel 23 carrying a frusto-conic section 24 where the mandrel 23 and the conic section 24 cooperate with a bell mouthed member 26 to develop an annulus having a diameter which gradually decreases from the point referenced A to the point referenced B.

In well known fashion the anvil strands 17 and the malleable strands 18 advance continuously from left to right, as viewed in FIG. 1, while they are rotated in a clockwise direction (as viewed from the left side of FIG. 1) about the axis X—X which represents the longitudinal axis of the cable and the direction or path of advance of all the strands.

In order to encourage the various strands 17—17 and 18—18 to assume a uniform lead (such as is shown at 32) and to relieve stress upon the individual strands after the formation of the initial hollow core layer 11, the strands 17—17 and 18—18 are provided with a preform or curvature, such as is shown at 21—21 by leading the individual strands over and under appropriate pulleys or eyelets as they advance from the strander drum in well known fashion.

Note that all strands 17—17 and 18—18 are generally circular in cross section prior to entering the forming die as is evidenced by the rotated sections shown in FIG. 1 at 27.

In contrast, corresponding rotated sections selected in incremental fashion along the die annulus show that the anvil strands 17 retain their generally circular cross section as these strands pass through the opening between the bell mouthed member 26 and the surface presented by the combined mandrel 23 and the conic section 24.

The work performed by the anvil strands 17 upon the intermediate malleable strands 18 is evidenced by the gradual change or transition in the cross-section configuration of the malleable strands, referenced 18a through 18g, as they proceed from the vicinity of the point referenced A to the discharge side of the forming die.

The malleable strands are usually selected so that they are somewhat larger in diameter in comparison to the diameter of the anvil strands. Thus, the first deformation occurring in the malleable strands is evidenced by a generally flattening of opposed sides of the strand as evidenced by the reference numeral 28.

Deformation of the malleable strands continues until at the point of discharge from the annulus the malleable strand assumes a generally dumbbell-like configuration as evidenced by the reference numeral 29.

In effect, the anvil strands 17 have been utilized to deform the malleable strands so that the combination of this deformation step plus the stranding step is effective to produce a hollow core layer of strands, such as is shown at 11, which effects a crush-resistant, yet flexible, layer of strands. The hollow layer of strands is circular in cross section.

It is thereafter possible to strand additional layers upon the hollow core 11 to build up a plurality of layers, such as illustrated in FIG. 2, to develop a cable.

It is anticipated that a variety of modifications and design changes may be effected, particularly in the selection of the material from which the anvil and malleable strands are formed, without departing from the spirit and scope of the invention.

It is to be especially noted that the various malleable and anvil strands need not be fabricated in all events from metallic materials. For example, it is well within the contemplation of the present invention that the malleable strands be formed of a plastic material susceptible of deformation while the anvil strands be formed of metal

or of a rigid plastic material where the rigid material has sufficient body to deform the malleable strands.

Furthermore, it is contemplated that the strand deformation steps disclosed and subsequently claimed need not be limited to the use of a die having an annular opening; but, may be practiced by passing the strands through a die opening of any desired cross-section such as a rectangular or square cross-section.

What is claimed is:

1. A hollow core cable comprising a plurality of circular, concentric layers of strands where each layer of strands is distinct from the strands of the other layers, the innermost layer of strands defining said hollow core and being nested side by side so as to cooperate with one another to produce a crush resistant hollow tube-like layer resisting a circumferential stress tending to collapse said innermost layer, said innermost layer being fabricated of strands of steel and aluminum, the steel and aluminum strands being disposed alternately.

2. A hollow core cable comprising a plurality of circular, concentric layers of strands wherein each layer of strands is distinct from the other layers, an innermost layer of strands defining said hollow core comprising hard and soft strands which are disposed alternately in side by side relation, said hard strands being nested within said soft strands, said hard and soft strands being adjacent said hollow core and resisting a circumferential stress tending to collapse said innermost layer.

3. A crush resistant hollow core cable comprising a plurality of circular, concentric layers of strands wherein each layer of strands is distinct from the other layers, the innermost layer of strands defining said hollow core comprising relatively hard and relatively soft strands disposed in side by side relation, said hard and soft strands being nested together with the hard strands partially received within the soft strands, whereby said innermost layer resists a circumferential stress tending to collapse said innermost layer.

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